MODEL 3-D

3∅ DIGITAL OSCILLATOR

OPERATIONS AND SERVICE MANUAL

PACIFIC
POWER SOURCE CORP.

CERTIFICATION

Pacific Power Source Corporation certifies that this instrument was thoroughly tested and inspected and found to meet or excel its published specifications when it was shipped from the facility.

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3-D 3Ø DIGITAL PLUG-IN OSCILLATOR

OPERATIONS AND SERVICE MANUAL

PACIFIC PART NO. 108350

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MODEL 3-D DIGITAL OSCILLATOR PLUG-IN

TABLE OF CONTENTS

1.0 GENERAL DESCRIPTION

1.1 General Characteristics

1.2 Performance Specifications

1.3 Operating Characteristics

2.0 TECHNICAL DESCRIPTION

2.1 Theory of Operation

2.1.1 Parts List

2.2 Oscillator Card Assembly

2.2.1 Theory of Operation
2.2.2 Parts List

2.3 Display Card Assembly

2.3.1 Theory of Operation
2.3.2 Parts List

2.4 Switch Card Assembly

2.4.1 Theory of Operation
2.4.2 Parts List

3.0 CALIBRATION AND ALIGNMENT

4.0 MAINTENANCE AND REPAIR

5.0 ENGINEERING MODIFICATIONS

MODEL 3-D DIGITAL OSCILLATOR PLUG-IN

LIST OF ILLUSTRATIONS

FIGURE	2.1A	SYSTEM BLOCK DIAGRAM
	2.1B	SYSTEM ASSEMBLY DRAWING
	2.2A	OSCILLATOR CARD SCHEMATIC DIAGRAM
	2.2B	OSCILLATOR CARD ASSEMBLY DRAWING
	2.3A	DISPLAY CARD SCHEMATIC DIAGRAM
	2.3B	DISPLAY CARD ASSEMBLY DRAWING
	2.4A	SWITCH CARD SCHEMATIC DIAGRAM
	2.4B	SWITCH CARD ASSEMBLY DRAWING

1.0 GENERAL DESCRIPTION

1.1 General Characteristics

All three "K" Series Pacific AC Power Sources with a "D" in the model number suffix utilize the 3-D Digital Oscillator Plug-in. This oscillator generates three-phase digitally-synthesized sine waves of exceptional quality and features two digital meters for both voltage and frequency readout.

The digital signal generator forms both single and three-phase vectors from a common high frequency clock; since these vectors are generated from programmed memories, there are no phase or amplitude imbalances when shifting frequency. The plug-in includes two 3½ digit LED displays; the first monitors frequency continuously, the other is switch selectable to read volts or amps of any phase.

Special frequency control ranges and digital control interface can be supplied to meet user requirements; refer to section 5 of this manual if your machine has been modified.

1.2 Performance Specifications

Frequency Control: Two continuously variable ranges 20-200 and 200-2000 Hz, plus three precision fixed frequencies at 50, 60, 400 Hz, or at other user specified frequencies.

NOTE: Units with internal autoformer: Model numbers with suffix D will have the low frequency range restricted to 45 Hz and the high frequency range restricted to 500 Hz.

Amplitude Control: Continuously variable 0 to V max. Three phase units include balance controls for each phase with a range of ±10%.

Phase Separation Accuracy: 1^{o} max. (3Ø units only)

Signal Distortion: 0.25% max.

Amplitude Stability: 0.01% per ^{o}C.

Frequency Stability: 0.01% per ^{o}C.

Freq. Meter Accuracy: 0.25% ±1 digit

Freq. Meter Resolution: 0.1 Hz on 20-200 range
1.0 Hz on 200-2000 range

1.2 Performance Specifications Continued

Voltmeter Function: Nine position function switch permits user to monitor volts any phase to neutral, volts phase to phase and amps any phase.

Voltmeter Accuracy: 0.25% ± 1 digit

Ammeter Accuracy: 5.0%

1.3 Operating Characteristics

The 3-D Plug-in is well suited for applications requiring quality power and versatility. Multi-turn precision controls and digital monitoring of all parameters combine to allow precise setting of output voltage and frequency.

1.3.1 Frequency Selection

The mode of operation is selected by the "Frequency Select Switch". A choice of preset frequencies of 50, 60, or 400 Hz or variable control ranges of 20-200 and 200-2000 Hz is made by this switch as well as any special frequencies or ranges that may have been installed. In the variable ranges, the frequency is set by the "Frequency Adjust" control. There is no noticable phase error and little voltage change when changing frequency.

1.3.2 Voltage Adjustment

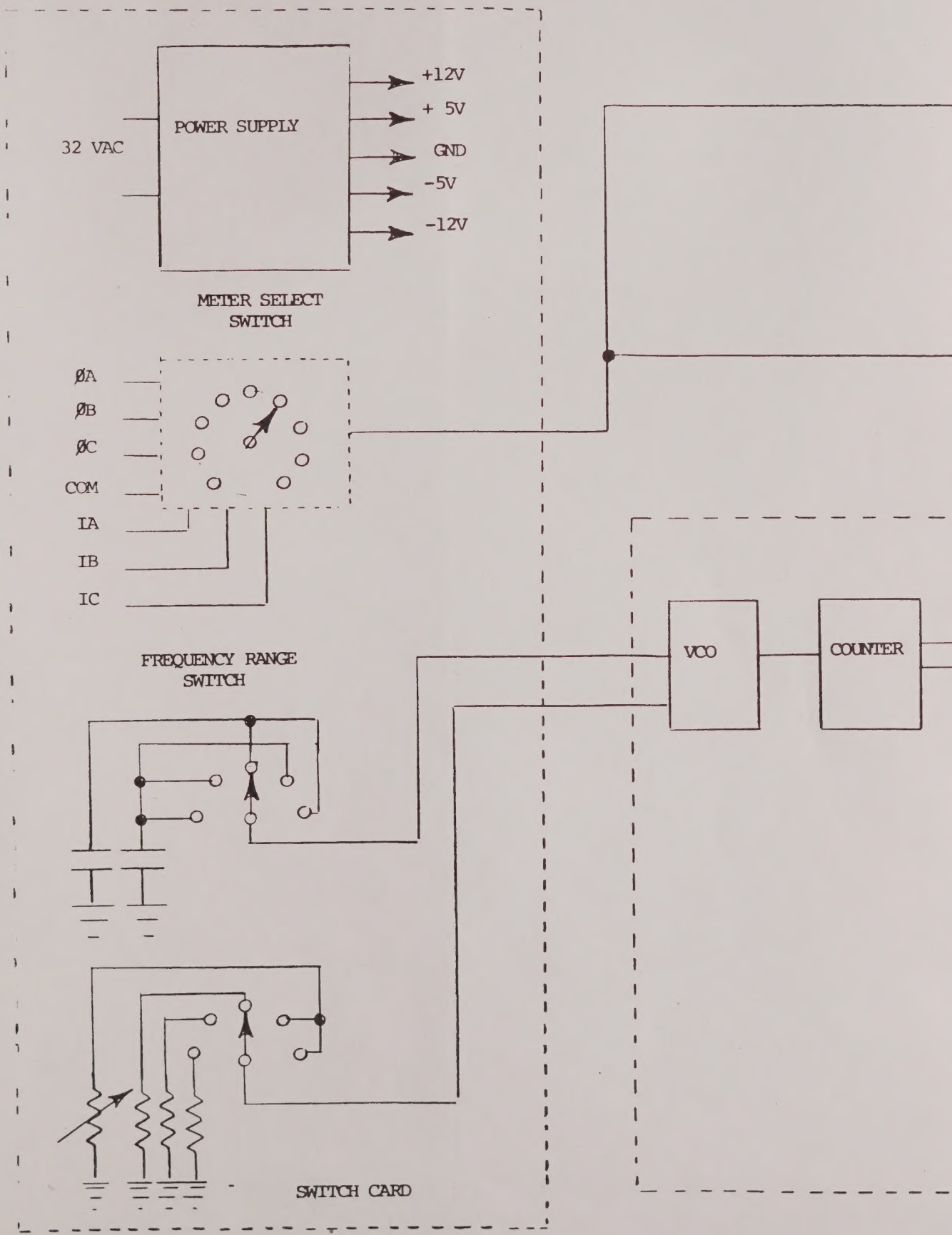
The output voltage is set by the multi-turn "Voltage Adjust" control which will vary the output of all three phases from 0 to rated output voltage. Once the three phases have been balanced by the balance controls, they should track from 0 to full output; this balance adjustment should be done at the desired output voltage for maximum accuracy.

1.3.3 Meter Selection

The "Meter Select" switch allows monitoring of any output phase-to neutral or phase-to-phase voltage, or any phase current; panel lights indicate which scale is being used. Note that the frequency and voltage metering functions are highly accurate and that the current metering is for indication only.

1.3.4 Digital Displays

Dual 3½ digit displays monitor output voltage, frequency, and current. Range scaling is automatically accomplished in the frequency and meter select switches.


POWER SUPPLY
32 VAC
+12V
+ 5V
GND
-5V
-12V
METER SELECT SWITCH
ØA
ØB
ØC
COM
IA
IB
IC
FREQUENCY RANGE SWITCH
VCO
COUNTER
SWITCH CARD

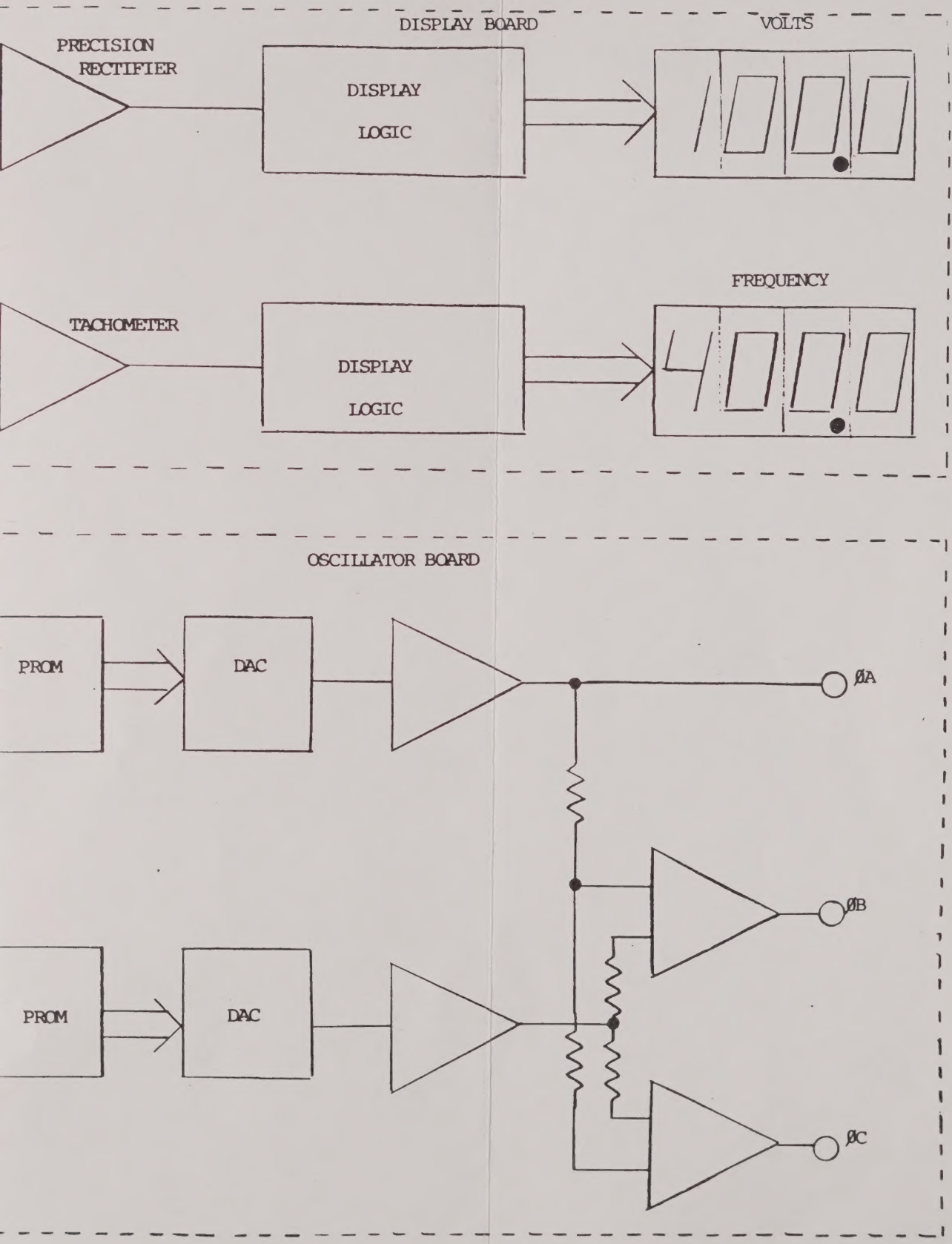
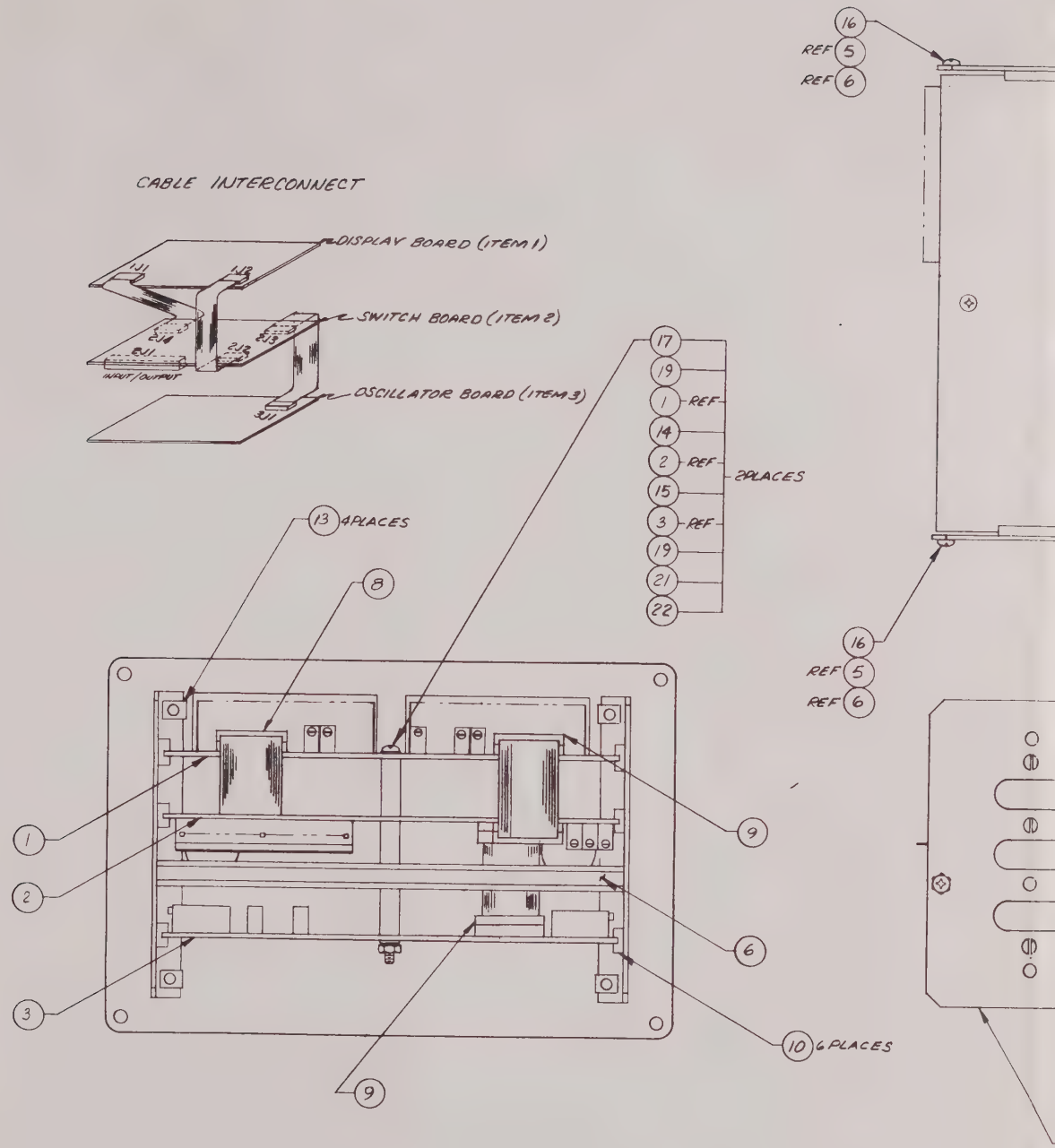


FIGURE 2.1A 3D PLUG-IN SYSTEM BLOCK DIAGRAM



NOTES: UNLESS OTHERWISE SPECIFIED.

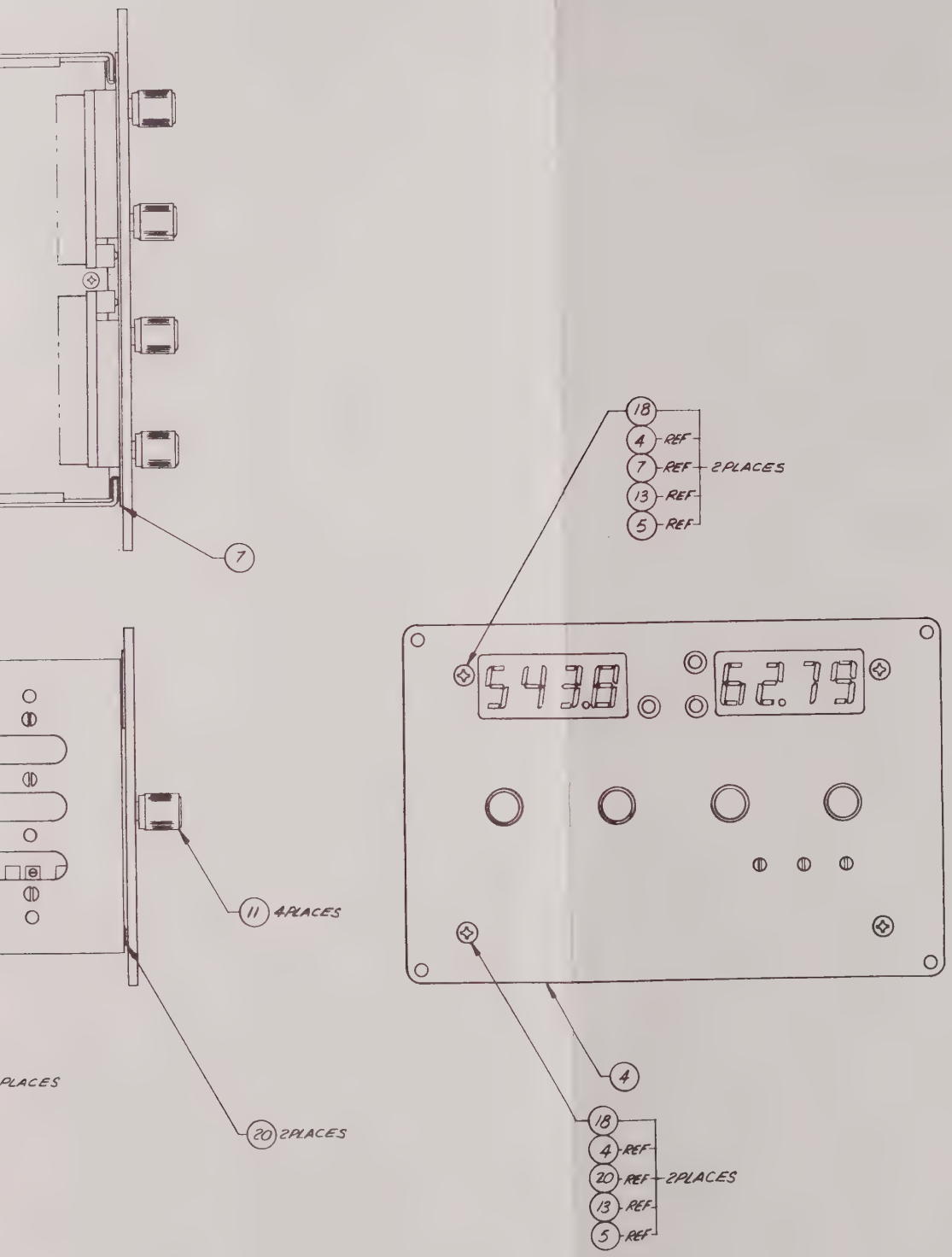


FIGURE 2.1B
ASSEMBLY DRAWING

See Material List 108300-4

2.0 TECHNICAL DESCRIPTION

2.1 Theory of Operation

The oscillator portion of the 3-D plug-in uses the principal of counting through cycles of a memory to generate a binary word weighted with a sine bit function; a digital-to-analog converter converts this word into a smooth sine wave. An identical circuit generates another sine wave 90° out of phase with the first; these are then algebraically added to form 120° and 240° vectors. To control the output voltage of all outputs, it is necessary only to vary the DAC reference voltage. Frequency control is accomplished by selection of the timing components of the clock generator.

The display portion features two identical 3½ digit DVM's with 0-2VDC input. The frequency counter uses a precision tachometer and low pass filter to measure the signal frequency and the voltage portion uses a precision rectifier to convert the selected AC to DC. All range-scaling is done on the switch card assembly.

The switch card assembly performs all range-scaling and voltage and frequency selection with printed circuit mounted switches and controls. The low voltage power supplies are also located on this card.

2.2 Oscillator Card Assembly

2.2.1 Theory of Operation

Refer to Figures 2.1A, 2.2.1A and 2.2.1B and section 2.1 of this manual, along with this technical description.

Voltage controlled oscillator Z1 generates a clock signal at 528 times the output frequency; the resistance from Z1-6 to ground and the capacitance from Z1-Z to Z1-3 determine this frequency. These parts are located on the switch card assembly. Z2 and Z3 form an 8-bit counter to drive memories Z4 and Z7; note that the MSB of Z7 is driven out of phase with that of Z4. Each memory is programmed with one-half a sine wave so that Z7 is 90° out of phase with Z4. Each memory feeds a current-to-voltage converting amplifier which outputs positive going, full-wave rectified signals. Each of these is inverted and switches driven by the sine bit alternate half-cycles to generate clean sine waves 90° out of phase.

2.2.1 Theory of Operation Continued

Amplifiers A3 and A6 are buffers to the clock noise filters and scale the voltage to the desired output levels. Amplifiers A9 and A10 are summing amplifiers that add the 0^{o} and 90^{o} signals to form 120^{o} and 240^{o}. Buffers A8 allows all three phases to have independent balance controls.

2.3 Display Card Assembly

Refer to Figures 2.1A, 2.3.1A and 2.3.1B and section 2.1 of this manual, along with this technical description.

The display portions of this card are identical and consist of a 3½ digit analog-to-digital logic sub-system formed by Z3-Z4 and Z8-Z9, BCD-to-Seven Segment decoders Z5 and Z10, and LED drivers Z6-Z7 and Z11-Z12.

The display is the conventional, the dual-slope integration method with a 1-4Hz update rate; please refer to the manufacturer's specs for complete details of circuit operation. Each display has a zero and a full scale adjustment. The frequency channel uses a precision tachometer circuit Z1-Z2 and filters to generate a DC voltage proportional to frequency. It is range scaled automatically by the Frequency Select switch.

The voltage channel uses a differential amplifier A3 and precision rectifiers A4 to generate a DC voltage proportional to the voltage selected by the meter select switch.

2.4 Switch Card Assembly

2.4.1 Theory of Operation

The switch card assembly performs all range-scaling and output voltage and frequency selection; it also contains all low voltage power supplies.

Two identical six-pole, nine position PC mounted switches are located on the switch card assembly. Switch S1 controls the frequency ranges and S2 the meter select for voltage according to the following legend.

S1-A, oscillator timing	S2-A, display decimal point
S1-B, 0^{o} filter	S2-B, range scale
S1-C, 90^{o} filter	S2-C, range scale
S1-D, display scaling	S2-D, phase select
S1-E, display decimal point	S2-E, phase select
S1-F, oscillator timing resistor	S2-F, voltage/current select

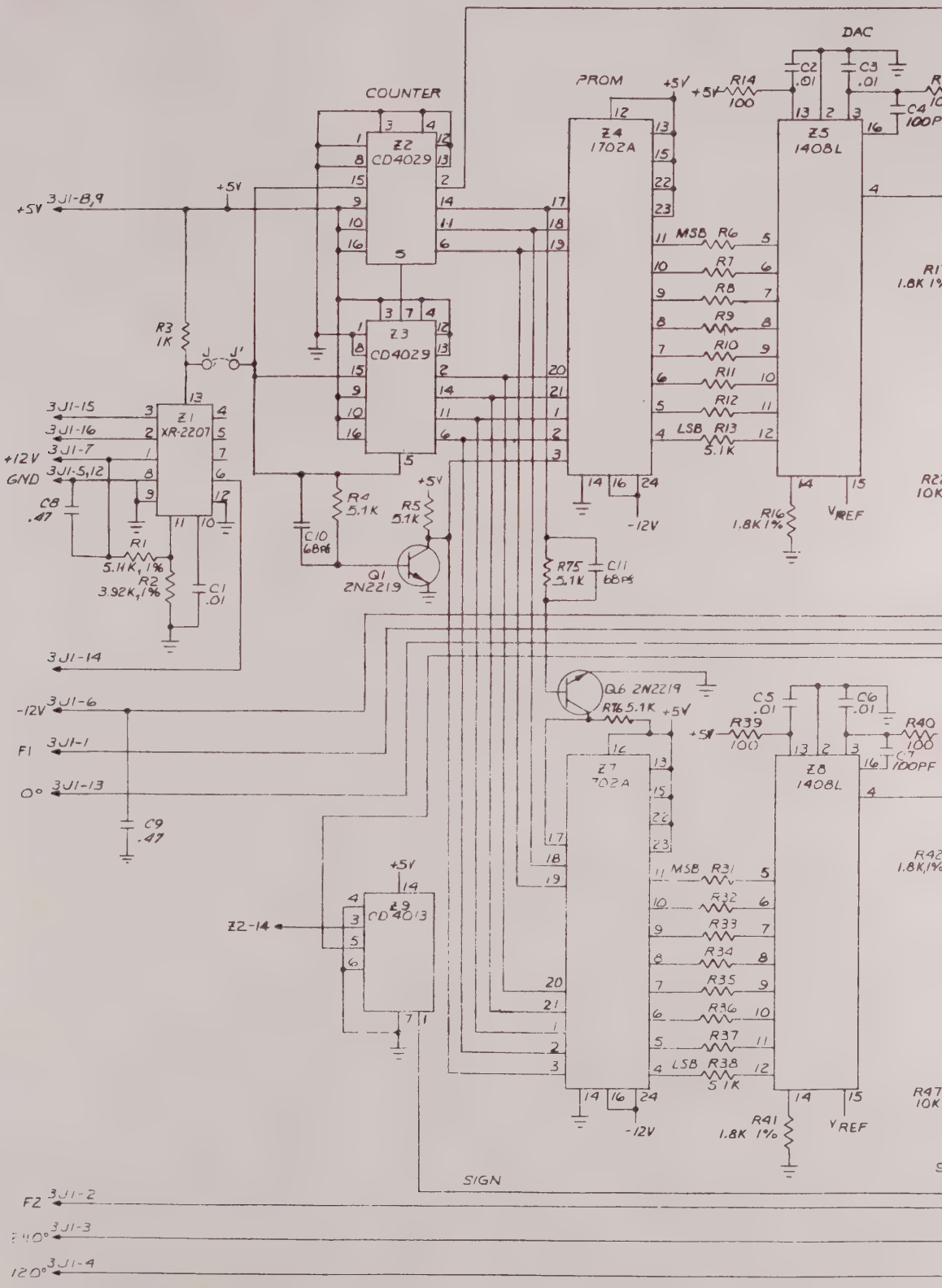
2.4.1 Theory of Operation Continued

The power supply section consists of a full-wave bridge rectifier and filter and four integrated circuit regulator chips Z1-Z4. Unfiltered display voltage is regulated by Q1.

2.1.1

PARTS LIST 3-DM 3Ø DIGITAL SIGNAL GENERATOR DRAWING NO. 108300-1

ITEM	DESCRIPTION	MFG P/N	MFG	QTY
01	DISPLAY ASSEMBLY	108361	PEE	1
02	CONTROL SWITCH ASSY	108360	PEE	1
03	OSCILLATOR CIRCUIT ASSY	108362	PEE	1
04	FRONT PANEL	108301	PEE	1
05	SIDE PANEL	108302	PEE	2
06	STANDOFF #4-40 x 6.06 Long	108304	PEE	1
07	LENS	108303	PEE	1
08	CABLE ASSY #1	570005	PEE	1
09	CABLE ASSY #2	570006	PEE	2
10	CARD GUIDE	1205F	SAE	6
11	KNOB	KN-501B-1/8	ALCO	4


SIGN
3J1-10
DAC
COUNTER
PROM
+5V
Z2 CD4029
Z3 CD4029
Z4 1702A
Z5 1408L
R14 100
C2 .01
C3 .01
C4 100P
3J1-8,9
R3 1K
J
J'
MSB R6
R7
R8
R9
R10
R11
R12
LSB R13 5.1K
Z1 XR-2207
3J1-15
3J1-16
3J1-7
3J1-5,12
+12V
GND
C8 .47
R1 5.11K, 1%
R2 3.92K, 1%
C1 .01
3J1-14
R4 5.1K
R5 5.1K
C10 68PF
Q1 2N2219
R75 5.1K
C11 68PF
R16 1.8K 1%
VREF
-12V
Q6 2N2219
R76 5.1K
C5 .01
C6 .01
R39 100
R40 100
C7 100PF
Z7 702A
Z8 1408L
MSB R31
R32
R33
R34
R35
R36
R37
LSB R38 5.1K
R41 1.8K 1%
YREF
-12V
3J1-6
3J1-1
3J1-13
F1
0°
C9 .47
Z9 CD4013
Z2-14
SIGN
F2
240°
120°
3J1-2
3J1-3
3J1-4

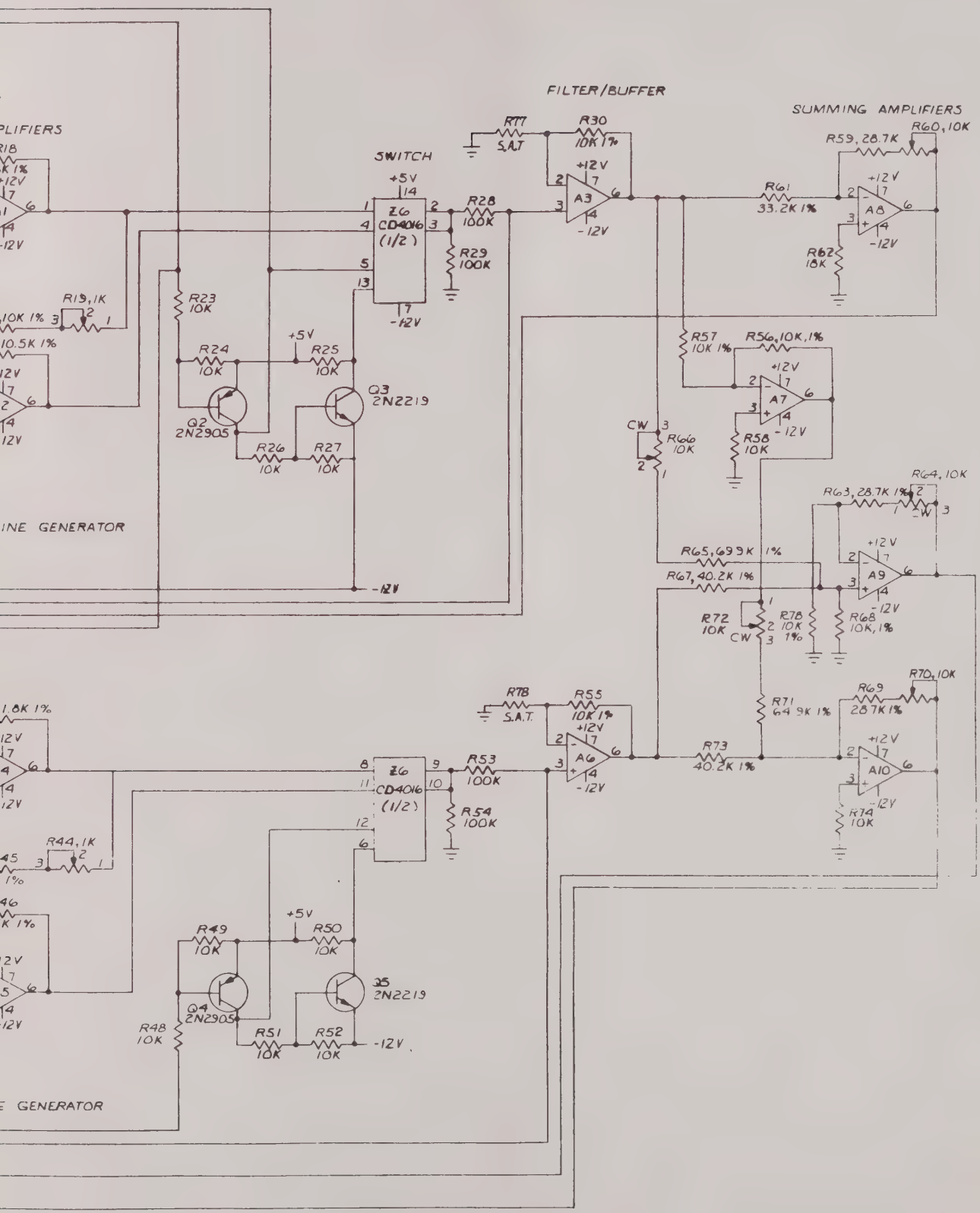
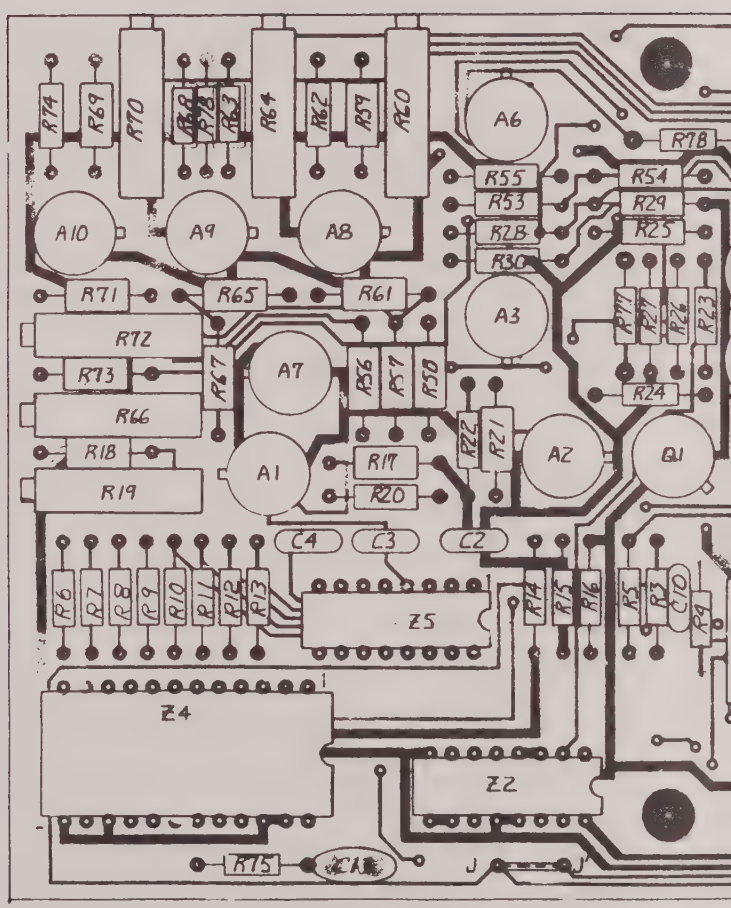
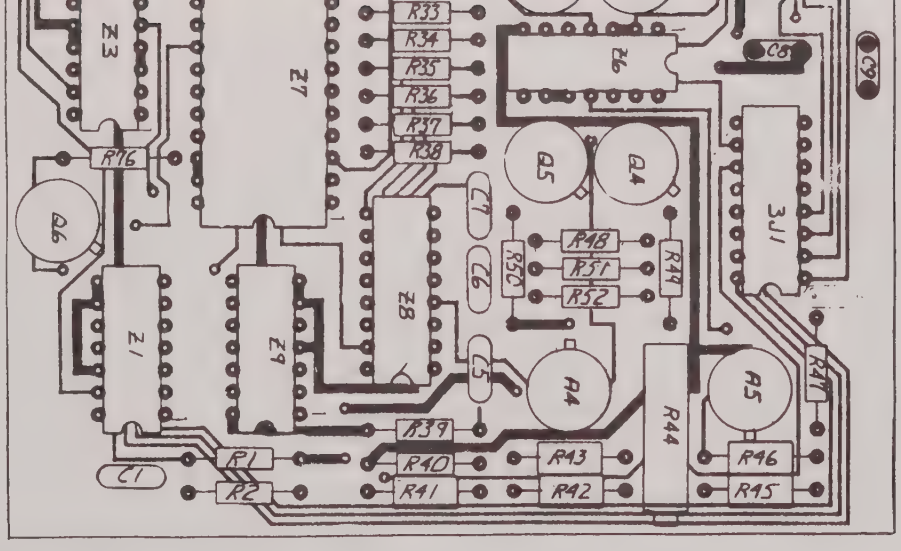


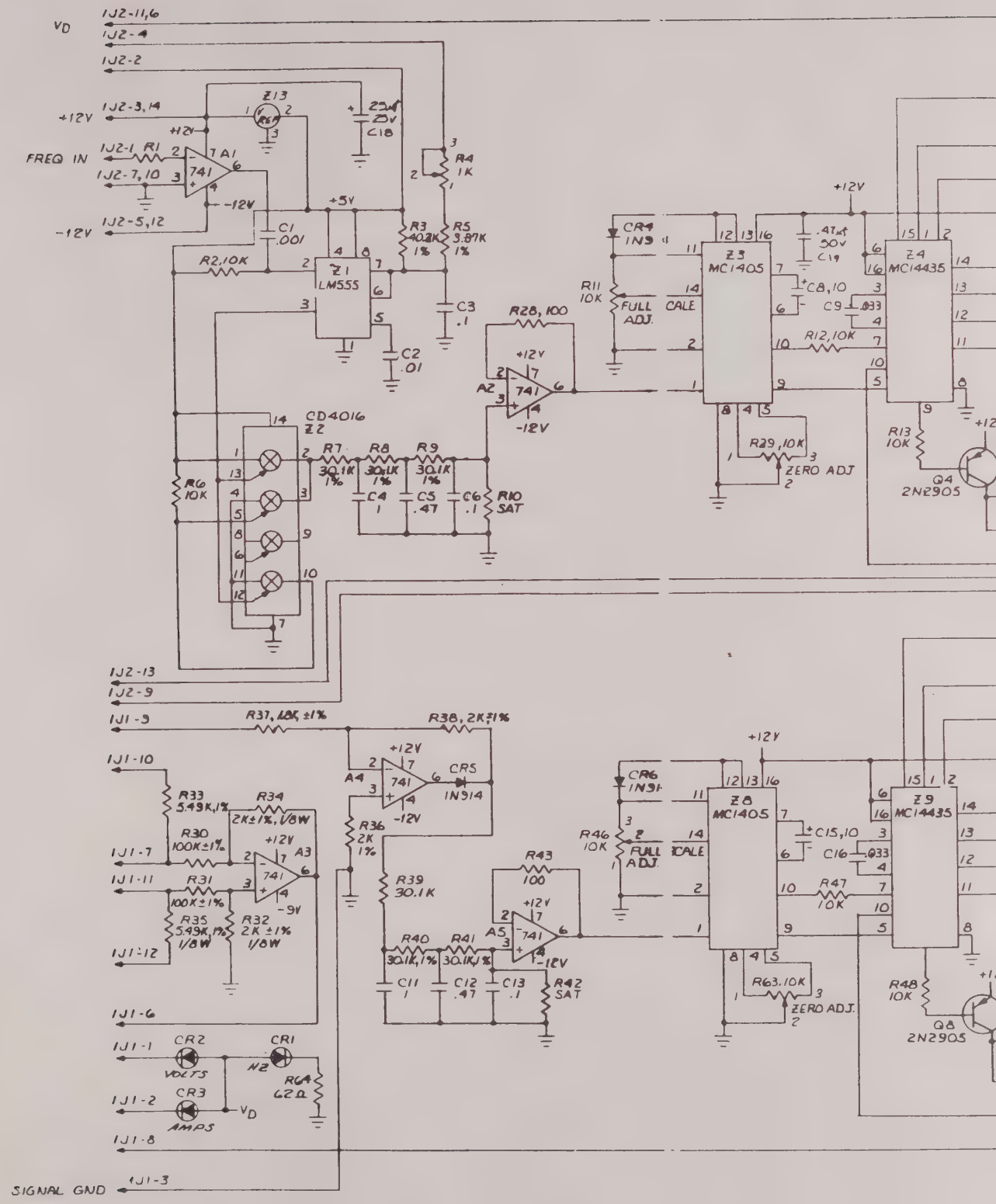
FIGURE 2.2A
OSCILLATOR CARD SCHEMATIC DIAGRAM


R74
R69
R70
R64
R62
R59
R60
A6
R78
R55
R54
R53
R29
R28
R25
R30
A10
A9
A8
R71
R65
R61
A3
R72
R73
R67
A7
R56
R57
R58
R24
R66
R22
R21
A2
Q1
R18
A1
R17
R19
R20
C4
C3
C2
R6
R7
R8
R9
R10
R11
R12
R13
Z5
R14
R15
R16
R5
R3
C10
R4
Z4
Z2
R75
C1
J
J'



FOR LIST OF MATL SEE MB362-4

FIGURE 2.2B
OSCILLATOR CARD ASSEMBLY DRAWING



1 C7 & C14 NOT USED.
NOTE: UNLESS OTHERWISE SPECIFIED

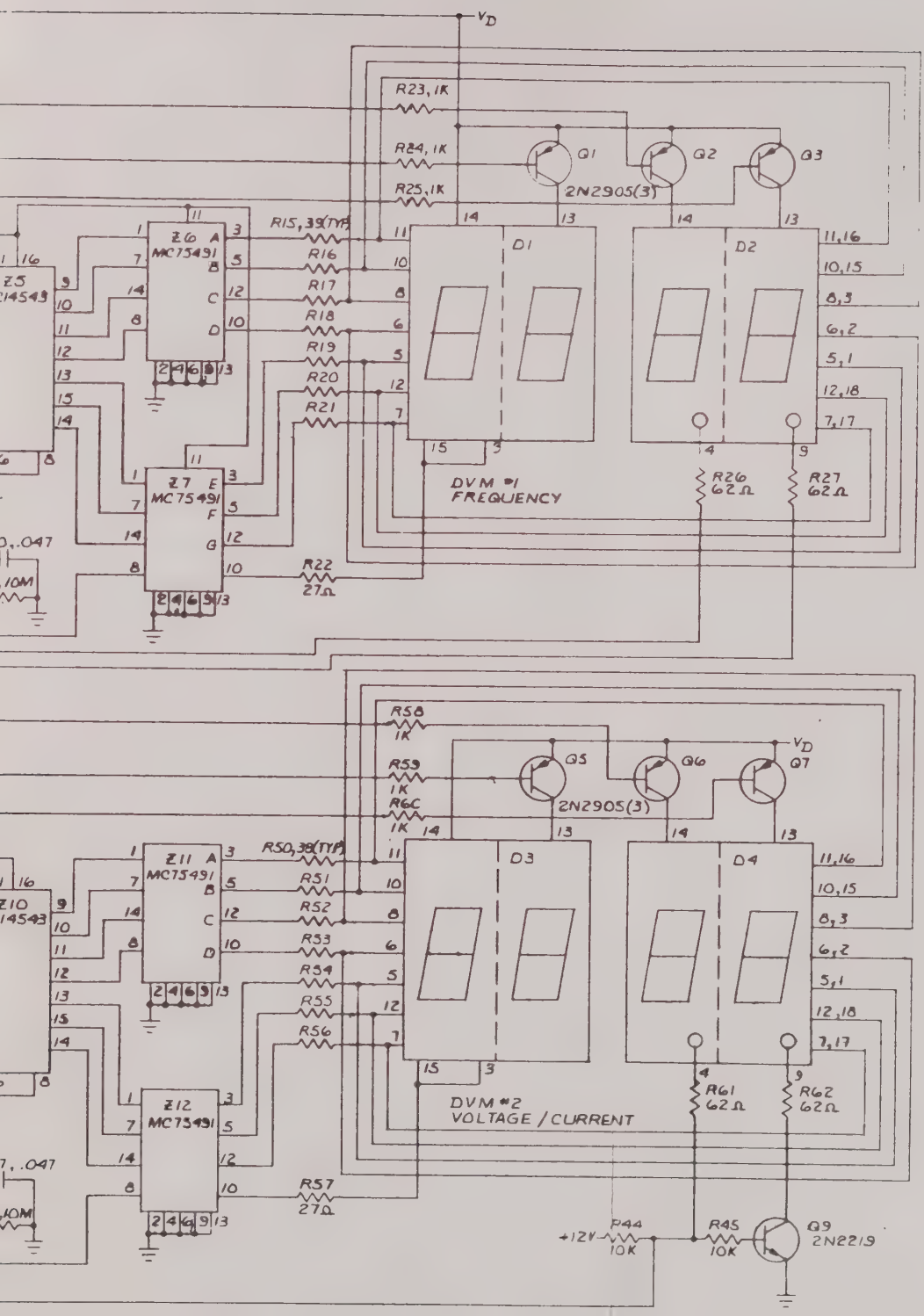
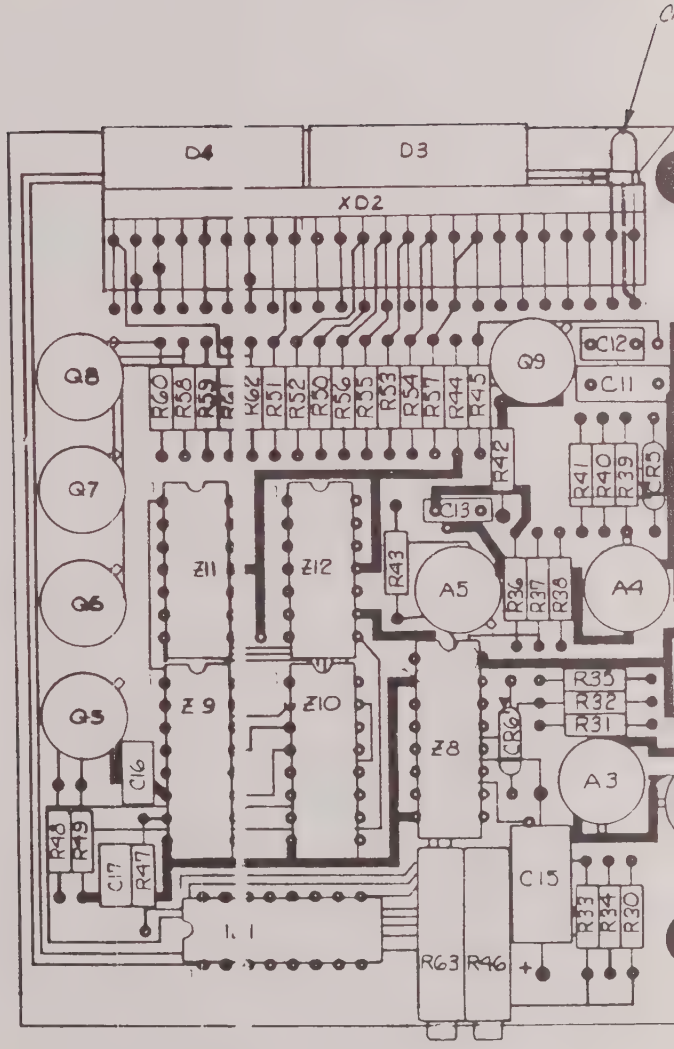


FIGURE 2.3A
DISPLAY CARD SCHEMATIC DIAGRAM


D4
D3
XD2
Q8
Q7
Q6
Q5
Q9
C12
C11
R60
R58
R59
R61
K64
R51
R52
R50
R56
R55
R53
R54
R57
R44
R45
R42
R41
R40
R39
CR5
C13
R43
Z11
Z12
A5
A4
R36
R37
R38
R35
R32
R31
Z9
Z10
Z8
CR62
A3
C16
R48
R49
C17
R47
C15
R33
R34
R30
I. I
R63
R46
+

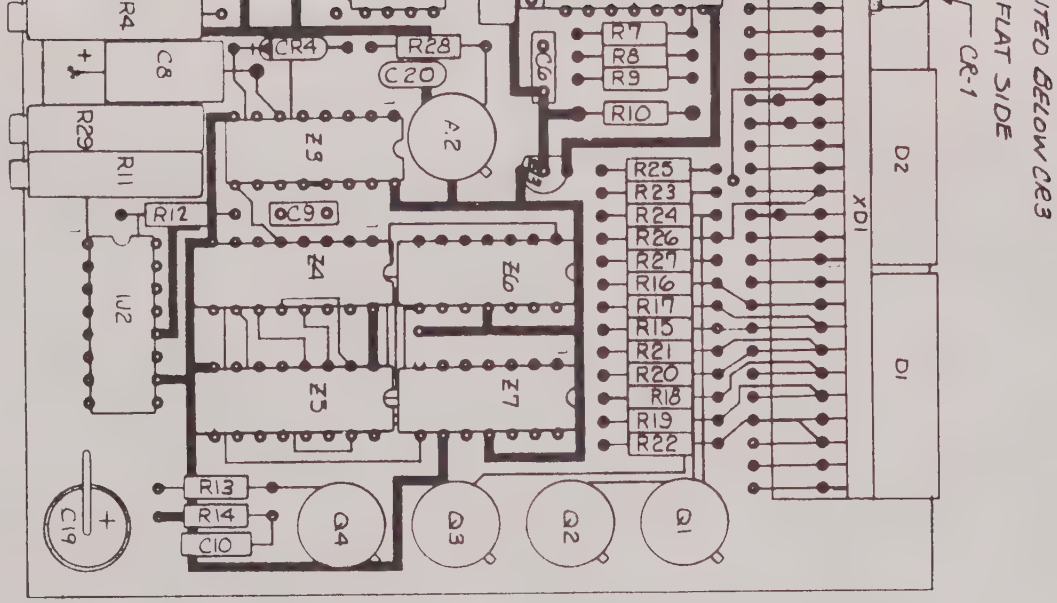
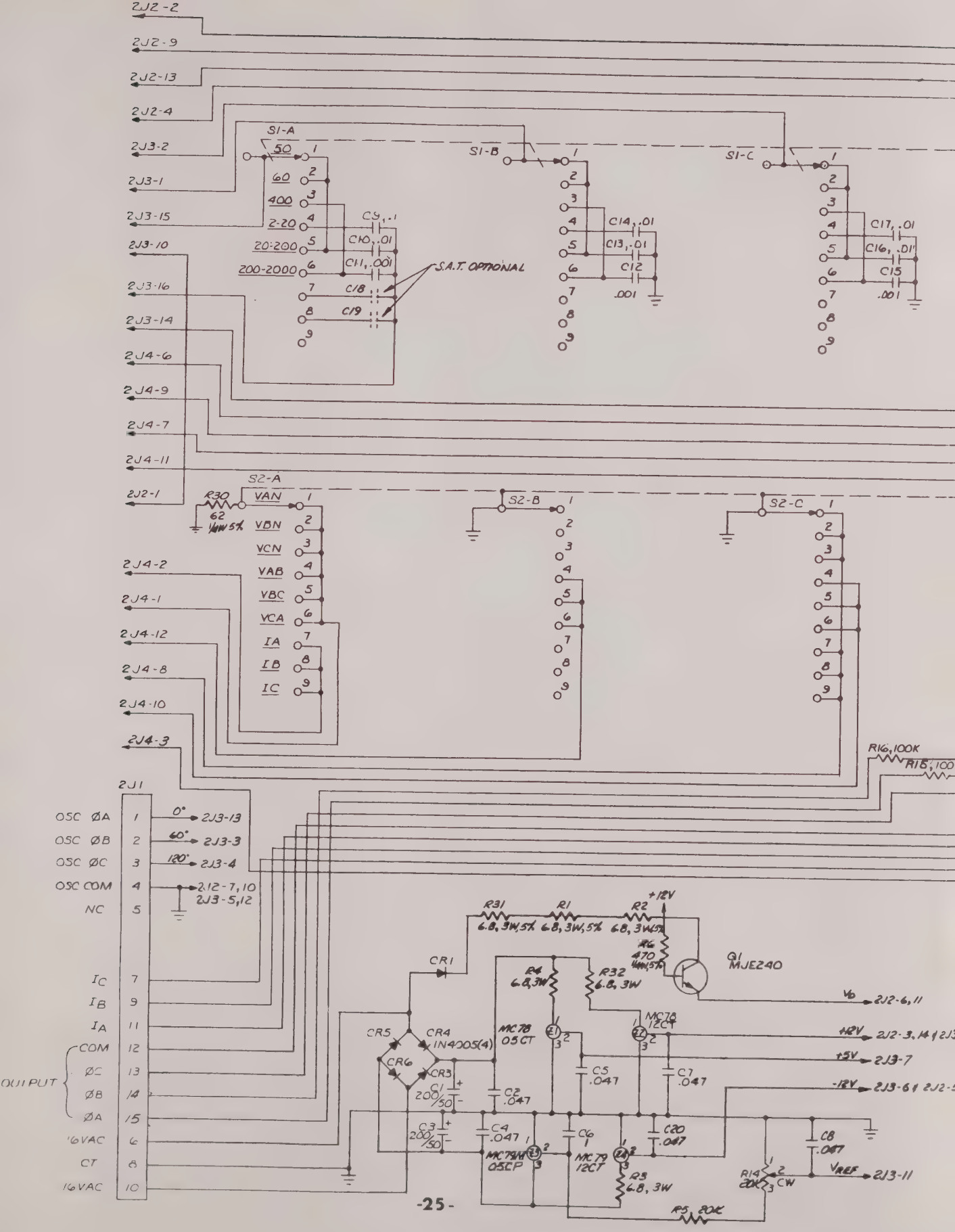
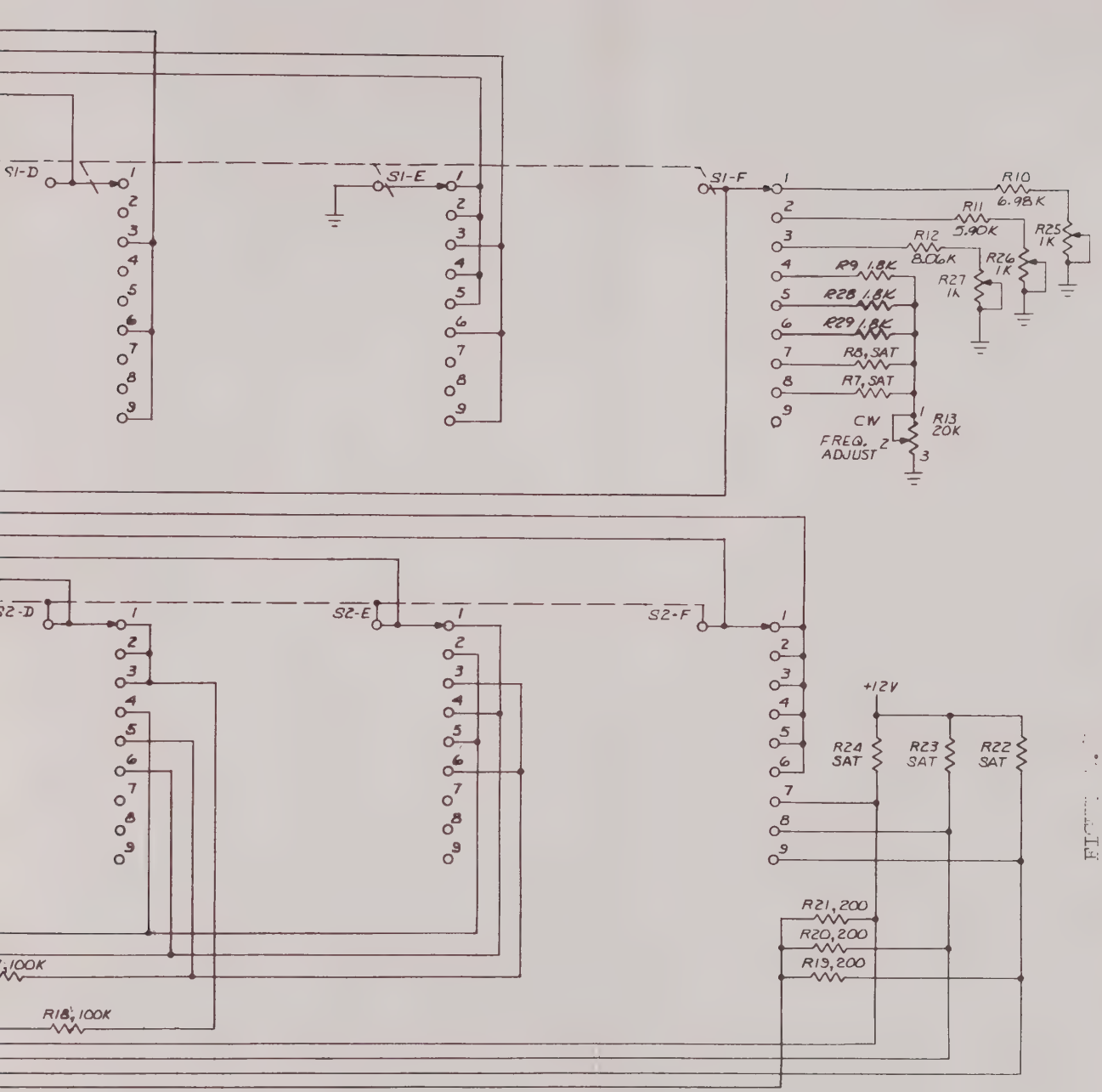


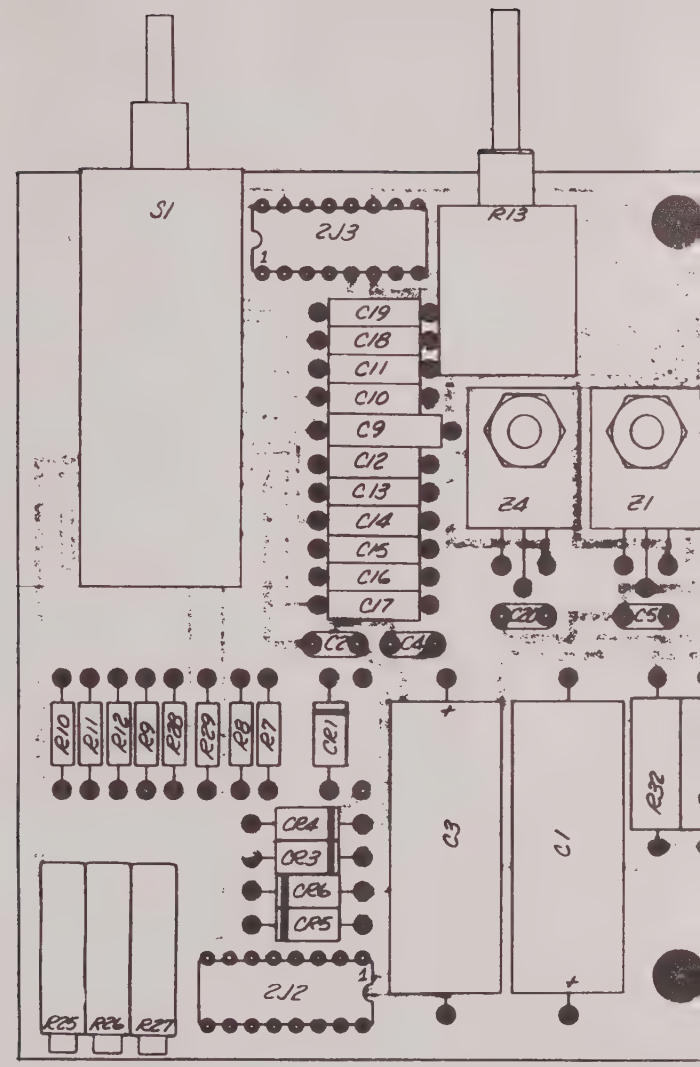
FIGURE 2.3B
DISPLAY CARD ASSEMBLY DRAWING


2J2-2
2J2-9
2J2-13
2J2-4
2J3-2
2J3-1
2J3-15
2J3-10
2J3-16
2J3-14
2J4-6
2J4-9
2J4-7
2J4-11
2J2-1
S1-A
50
60
400
2-20
20-200
200-2000
C9, .1
C10, .01
C11, .001
C18
C19
S.A.T. OPTIONAL
S1-B
C14, .01
C13, .01
C12
.001
S1-C
C17, .01
C16, .01
C15
.001
S2-A
R30
62
1/4W 5%
VAN
VBN
VCN
VAB
VBC
VCA
IA
IB
IC
S2-B
S2-C
2J4-2
2J4-1
2J4-12
2J4-8
2J4-10
2J4-3
R16, 100K
R15, 100
2J1
OSC ØA
OSC ØB
OSC ØC
OSC COM
NC
0° → 2J3-13
60° → 2J3-3
120° → 2J3-4
2J2-7, 10
2J3-5, 12
IC
IB
IA
COM
ØC
ØB
ØA
OUTPUT
16VAC
CT
16VAC
+12V
R31
6.8, 3W, 5%
R1
6.8, 3W, 5%
R2
6.8, 3W, 5%
R6
470
1/4W 5%
Q1
MJE240
CR1
R4
6.8, 3W
R32
6.8, 3W
VB → 2J2-6, 11
CR5
CR4
IN4005(4)
CR6
CR3
MC78
05CT
MC78
12CT
+12V → 2J2-3, 14 & 2J3
+5V → 2J3-7
-12V → 2J3-6 & 2J2-
C1
200/50
C2
.047
C5
.047
C7
.047
C3
200/50
C4
.047
MC79M
05CP
C6
MC79
12CT
C20
.047
C8
.047
R14
20K
CW
VREF → 2J3-11
R3
6.8, 3W
R5, 80K



SWITCH CARD SCHEMATIC DIAGRAM

NOTES: UNLESS OTHERWISE SPECIFIED.
1. ALL CAPACITOR VALUES ARE IN MFD.
2. ALL RESISTOR VALUES ARE IN OHMS, 1/8W, 1%.



⚠1. MOUNT Z1-Z4 & Q1 GOLD SIDE DOWN.

NOTES: UNLESS OTHERWISE SPECIFIED

FIGURE 2.4B
SWITCH CARD ASSEMBLY DRAWING

SEE MATERIAL LIST 108360-4

ITEM	DESCRIPTION	MFG P/N	MFG	QTY
	OSCILLATOR PRINTED CIRCUIT BOARD	PC108362	PPSC	1
	OPERATIONAL AMPLIFIER A1-10	LM741C		10
	CAPACITOR .01 µf @50 C1-3, 5,6	2CO2310D8500C4	SPRAGUE	5
	TRANSISTOR Q1,3,5,6	2N2219		4
	TRANSISTOR Q2,4	2N2905		2
	RESISTOR, 1.8K Ω,1/8W,1% R16-18,41-43	RN55C1801		6
	RESISTOR,3.92KΩ 1/8W,1% R2	RN55C3921		1
	RESISTOR, 5.11KΩ 1/8W,1% R1	RN55C5111		1
	RESISTOR, 10KΩ 1/8W,1% R20,45,56,57,68,78	RN55C1002		6
	RESISTOR 10.5KΩ 1/8W,1% R21,46	RN55C1052		2
	RESISTOR, 28.7KΩ 1/8W,1% R59,63,69	RN55C2872		3
	RESISTOR, 33.2 KΩ 1/8W, 1% R61	RN55C3322		1
	RESISTOR, 40.2KΩ ,1/8W,1% R67,73	RN55C4022		2
	RESISTOR, 64.9KΩ,1/8W, 1% R65,71	RN55C6492		2
	RESISTOR, 100Ω ¼W,5% R14,15, 39,40			4
	RESISTOR, 1KΩ ¼W,5% R3			1
	RESISTOR, 5.1KΩ ¼W,5%, R6-13,31-38 4,5,75,76			20
	RESISTOR 10KΩ ¼W,5%, R22-27,47-52,58,74			14
	RESISTOR, 18KΩ ¼W,5%, R62			1

ITEM	DESCRIPTION	MFG P/N	MFG	QTY
	RESISTOR 100 KΩ ¼W 5% R28,29,53-54			4
	POTENTIOMETER, 1KΩ R19,44	3009P-102	BOURNS	2
	POTENTIOMETER 10KΩ R60,64,66, 70,72	3009P-103	BOURNS	5
	INTEGRATED CIRCUIT Z6	CD4016AE	RCA	1
	INTEGRATED CIRCUIT Z5,8	1408L	PMI	2
	INTEGRATED CIRCUIT Z4,7	540128	PPSC	2
	INTEGRATED CIRCUIT Z1	XR2207	EXAR	1
	INTEGRATED CIRCUIT Z9	CD4013AE	RCA	1
	INTEGRATED CIRCUIT Z2,3	CD4029AE	RCA	2
	SOCKET-CABLE 3JI	516-AG10D	UAGAT	1
	CAPACITOR 68PF @500V C10,11	CMO4ED68JO3	ARCO	2
	CAPACITOR .47 µf @ 50V C8,9	2CO23474D8500C4	SPRAGUE	2
	CAPACITOR .01 µf @ 500V C4,7	5GAD10	SPRAGUE	2

PARTS LIST DISPLAY ASSY DRAWING NO. 108361-1

ITEM	DESCRIPTION	MFG P/N	MFG	QTY
	DISPLAY PRINTED CIRCUIT BRD	PC108361	PEE	1
	OPERATIONAL AMPLIFIER A1-5	LM741C		5
	CAPACITOR, .001 µf @50V C1	1CO67102X0500C4	SPRAGUE	1
	CAPACITOR .01 µf @ 50V C2	2CO23103D8500C4	SPRAGUE	1
	CAPACITOR .033 µf @ 50V C9,16	2CO23333D8500C4	SPRAGUE	2
	CAPACITOR .047 µf @ 50V C10, 17	2CO23473D8500C4	SPRAGUE	2
	CAPACITOR .1µ f @ 50V C3,6,13	730BIC104	ELECTROCUBE	3
	CAPACITOR .47 µf @ 50V C5,12,19	2CO23474D8500C4	SPRAGUE	3
	CAPACITOR 1 µf @ 50V C4,11	3CO23105D8500C5	SPRAGUE	2
	CAPACITOR, 10 µ f @ 25V C8	TE1204	SPRAGUE	1
	LED CR1-3	MV5054-2	MONSANTO	3
	DIODE CR4-6	IN914		3
	TRANSISTOR Q1-8	2N2905		8
	TRANSISTOR Q9	2N2219		1
	RESISTOR, 2KΩ , 1/8W, 1% R32,34,36,38	RN55C2001		4
	RESISTOR, 3.97KΩ R5	RN55C		1
	RESISTOR 30.1KΩ R7-9, 39-41	RN55C3002		6
	RESISTOR 5.49 KΩR33,35	RN55C5502		2
	RESISTOR 100 KΩ 1/8W 1% R30,31	RN55C1003		2
	RESISTOR 27 Ω ¼W 5% R22,57			2
	RESISTOR 39 Ω R15-21,50-56			14

ITEM	DESCRIPTION	MFG P/N	MFG	QTY
	RESISTOR, 62Ω ¼W,5% R26,27, 61-63			5
	RESISTOR, 100Ω ¼W,5% R43, R28			2
	RESISTOR, 1KΩ ¼W,1% R23-25,58-60			6
	RESISTOR, 10KΩ ¼W,5% R2,6,11-13,44-48			10
	RESISTOR, 10MEG Ω R14, 49			2
	RESISTOR, SAT, ¼W,5% R10,42			2
	INTEGRATED CIRCUIT Z1	LM555		1
	INTEGRATED CIRCUIT Z2	CD4016	RCA	1
	INTEGRATED CIRCUIT Z3,8	MC1405	MOT	2
	INTEGRATED CIRCUIT Z4,9	MC14435	MOT	2
	INTEGRATED CIRCUIT Z5,10	MC14543	MOT	2
	INTEGRATED CIRCUIT Z6,7,11, 12	MC75491	MOT	4
	DIGITAL DISPLAY D1-4	MAN6610	MONSANTO	4
	POTENTIOMETER 1 KΩ R4	3009P-1-102	BOURNS	1
	POTENTIOMETER 10K R29,63	3009P-1-103	BOURNS	2
	DISPLAY SOCKET	508-AG8D	AUGAT	12
	EXTRUSION SOCKETS HARDWARE SUPPLIED	508-5P1-6	AUGAT	2
	SOCKET CABLE 1J1, 1J2	516-AG10D	AUGAT	2
	RESISTOR, 40.2 KΩ 1/8W,1% R3	RN55C4021		1
	CAPACITOR 25 µf @ 25V C18	TE-1209	SPRAGUE	1
	RESISTOR 18.2K 1/8W 1% R31			

CONTROL SWITCH BOARD

DRAWING NO. 108360-1

ITEM	DESCRIPTION	MFG P/N	MFG	QTY
	CONTROL SWITCH PRINTED CIRCUIT BOARD	PC108360	PEE	1
	CAPACITOR, .001 µf @ 200V C11,12,15	730B1C102	ELECTROCUBE	3
	CAPACITOR, .01 µf @ 200V C10,14,17,13,15	730B1C103	ELECTROCUBE	5
	CAPACITOR, .047 µf @ 50V C2,4,5,7,20	2CO2347308500C4	SPRAGUE	6
	CAPACITOR, .1 µf @ 200V C9	730BIC104	ELECTROCUBE	1
	CAPACITOR, 1 µf @ 50V C6	3CO23105D8500C5	SPRAGUE	1
	CAPACITOR, 100 pf @ 1KV C12,15	5GA-T10	SPRAGUE	2
	CAPACITOR, 200 µf @ 50V C1,3	207G050FF7	SPRAGUE	2
	DIODE CR2-6	IN4005		5
	TRANSISTOR Q1	MJE240	MOTOROLA	1
	RESISTOR, 200 Ω1/8W,1% R19-21	RN55C2000		3
	RESISTOR, 1.8KΩ R9,28,29	RN55C1801		3
	RESISTOR, 20KΩ R5	RN55C1002		1
	RESISTOR, 100KΩ R15-18	RN55C1003		4
	RESISTOR, SAT, 1/8W, 1% R7,8 22-24	RN55CXXXX		5
	RESISTOR, 470 Ω,¼W,5% R6			1
	RESISTOR, 62 Ω¼W,5% R30			1
	RESISTOR, 6.8 Ω,3W,5% R1-4, 31,32	RS2B	DALE	6
	POTENTIOMETER, 1 KΩ R25-27	3009P-102	BOURNS	3
	POTENTIOMETER, 20 KΩ R13,R14	83C1D-EZ8-J16	BOURNS	2
	SWITCH ROTARY S1-2	71AF36-06-1-9N	GRAYHILL	2

ITEM	DESCRIPTION	MFG P/N	MFG	QTY
	VOLTAGE REGULATOR Z1	MC7805CT	MOT	1
	VOLTAGE REGULATOR Z2	MC7812CT	MOT	1
	VOLTAGE REGULATOR Z3	MC7905CT	MOT	1
	CONNECTOR (15 PIN MALE) 2J1	09-64-1151	MOLEX	1
	SOCKET, CABLE 2J2,2J3,2J4	516-AG10D	AUGAT	3
	RESISTOR 6.98 KΩ 1/8W 1% R10	RN55C6981		1
	RESISTOR 5.90 KΩ 1/8W 1% R11	RN55C5901		1
	RESISTOR 8.06 KΩ 1/8W 1% R12	RN55C8061		1
	VOLTAGE REGULATOR Z4	MC7912CT		1

3.0 CALIBRATION AND ALIGNMENT

3.1 Requirements

Pacific Power Source Corporation recommends the calibration procedure be performed at six-month intervals or if the unit has undergone major repairs. All adjustments fall into the categories of either oscillator or display calibration.

3.2 Oscillator Calibration

3.2.1 Frequency Calibration

All frequency calibration components are located on the switch card assembly. Using a counter attached to the output terminals, make the following adjustments on the switch card:

3.2.1.1 Set the Frequency Select switch to 50Hz and adjust R25 until the frequency is 50±.1Hz.

3.2.1.2 Set the Frequency Select switch to 60 Hz and adjust R26 until the frequency is 60±.1Hz.

3.2.1.3 Set the Frequency Select switch to 400 Hz and adjust R27 until the frequency is 400 ±.5Hz.

3.2.2 Phase-Angle Calibration

3.2.2.1 Connect a phase-meter across ØA and ØB output; set outputs to approximately 100V and adjust R72 on the oscillator card for 120^{o} ±$.5^{o}$ phase separation.

3.2.2.2 With the phase-meter connected across ØA and ØC, adjust R66 for 120^{o} ±0.5^{o} phase separation.

3.2.2.3 Connect the phase meter across ØB and ØC; check for phase separation of 120 ±1^{o}. If out of spec, repeat 3.2.2.1 and 3.2.2.2.

3.2.3 Phase Balance

3.2.3.1 Set output of ØA to 100V and measure to an accuracy of ±.1V.

3.2.3.2 Adjust ØB for the value of ØA within ±.1V with front panel balance adjustment R70.

3.2.3.3 Adjust ØC for the value of ØA within ±.1V with front panel balance adjustment R64.

3.3 Display Calibration

3.3.1 Frequency Display Calibration

Set Frequency Select switch to 60 Hz position and connect a counter across the output terminals; adjust R11 on the display board until display matches the counter within ±.1 Hz.

Change Frequency Select switch to 400 Hz and adjust R4 until display reading matches the counter within ±1Hz.

3.3.2 Voltmeter Calibration

Set output of ØA to 100±.1V as measured with an external DVM. Adjust R46 on the display board for a display reading of 100 ±.1V on ØA position of meter select. Change Frequency Select switch to VAB and measure VAB with an external DVM. If readings vary more than ± 2V, it may be necessary to calibrate by padding R33 or R30 to bring in spec.

4.0 MAINTENANCE AND REPAIR

4.1 Disassembly

Refer to Figure 2.1A for assembly illustration. Remove the four knobs (item 11) and the card retaining standoffs. The three cards can then be slid out of the card cage and laid flat on a work bench for troubleshooting.

5.0 ENGINEERING MODIFICATIONS